U.S. SMALL COMPUTER SYSTEMS MARKET IN 1985

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Prepared For:

FUJITSU LIMITED

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I INTRODUCTION

I INTRODUCTION

A. PURPOSE AND SCOPE

- The objectives of this study were to structure and forecast the U.S. market in 1985 for computer systems currently in the $20,000 to $200,000 price range. An analysis of both the realized and potential segments of this market, in addition to a definition of the industry and application sectors, is presented. The competitive environment as well as distribution and support requirements are analyzed. The preceding is formulated in order to identify market opportunities and business strategies offering the greatest potential for Fujitsu in the 1985 timeframe.

B. RESEARCH AND METHODOLOGY

- Research for this study was divided into the following categories:

    - INPUT's analysis of trends of the industry and forecasts of IBM's, DEC's, and other leading-edge companies' strategies for the 1980s.

    - INPUT's analysis of available minicomputer products, and market and forecast information.

- INPUT's proprietary information based upon research performed for completed programs.

- Supplemental research with additional outside sources for checking and verifying the above information.

II EXECUTIVE SUMMARY

II   EXECUTIVE SUMMARY

A.   CONCLUSIONS

- The potential U.S. market for small computer system shipments (excluding government) is forecasted to increase from 1.3 billion units in 1980, to 2.5 billion units in 1985.

- Shipments into this market, valued at $4.4 billion in 1980, are projected to reach $18.5 billion by 1985, an AAGR of 33%.

    - The fastest-growing segment of this market is represented by Class C ($100,000-200,000) systems, with revenues anticipated to grow from a $1.0 billion level in 1980, to $5.5 billion in 1985. This growth will in large part be spurred by the burgeoning CAD/CAM market.

    - Class A ($20,000-49,000) system will lose its percentage market share of the three classes (54% to 46% of the total) despite maintaining an AAGR of 29%.

- The market penetration is expected to reach 45% within the forecast period of 1985.

- CAD/CAM is forecasted to grow at the fastest rate in the 1980-1985 timeframe, and the general business application will continue to account for over 60% of shipments installed in such environments.

- Five of the twenty-five cells in the growth matrix, comparing industry group with application, offer growth opportunities exceeding 350% in the 1980-1985 timeframe.

  - Manufacturing: CAD/CAM, general business, communication control.

  - Distribution (retail): communication control.

  - Finance and insurance: communication control.

- The primary driving forces that will accelerate the growth of these markets are:

  - Productivity demands combined with the shortage of skilled personnel.

  - Technology as the factor in driving product costs downward while energy and labor costs continue to inflate.

  - Increased government controls and regulations.

  - Communications (DDP) requirements will increase and result in greater demands placed upon the equipment maintenance function, particularly in remote areas.

- Industry-specialized application software requirements will be of particular importance in the manufacturing and distribution industries in response to the cost increases of doing business in the economic environment dominated by the driving forces discussed.

- Of particular interest will be the use of computers by the user for generating applications software.

• Post-sales support and maintenance of both hardware and software products is a key issue with both first time users as well as experienced data processing managers of major corporations.

• Methods of distributing small computer systems will trend toward alternative means as the cost per sales call increases and product price/performance improves. The migration away from traditional distribution channels will become most apparent for the small, Class A systems, which lend themselves more toward selling via retail store outlets.

• EDP managers will be impacted by recent important IBM announcements, resulting in a shortage of qualified technical personnel.

- The 43XX and 8100, announced in 1979, are designed to be used in a distributed environment and create problems for the EDP managers who now must develop adequate staff to support forthcoming applications.

- Concurrently, the requirement for dealing with increased communication complexity due to the anticipated surge in the number of on-line terminals to be installed will become stronger.

• 1980-1985 will be the "Age of Software," involving applications, tools, and productivity of personnel.

• Respondents to the INPUT User Panel reported that the largest annual budget percentage growth is in the small computer/programmable terminal category.

• There will be increased emphasis on the part of small computer manufacturers and distributors in the 1980-1985 timeframe toward service support, and the sale of additional peripherals and software to their installed customer bases. This added product sale will result in a more thorough penetration of the

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potential market and is forecasted to equal 15-25% of the cost of the originally installed unit.

B.   RECOMMENDATIONS

- Fujitsu should concentrate on high-growth applications within the manufacturing industry. Manufacturers are the most attractive market sector because they have:

    - Larger EDP budgets than other industries.

    - Higher personnel skill and pay requirements.

    - Greater price pressures from international competitors.

    - A greater variety of functional needs than other U.S. industries.

- Markets either dominated by one of the major U.S. computer manufacturers or crowded with suppliers should be avoided because of their potential to become arenas for aggressive price cutting.

- Fujitsu must recognize that during the 1980-1985 timeframe, revenues will shift from hardware to software, which will provide the user with that portion of the purchased product which can be truly differentiated.

- Considering the aforementioned factors, an analysis of market opportunities by Fujitsu should include the following issues:

    - The skilled personnel availability and productivity need.

- The role of communications during the dramatic DDP growth of the eighties, which will emphasize the management and transmission of data.

- The changing emphasis of distribution channels toward retail stores and system houses for computer system sales.

- The lack of an end user sales force or reputation of Fujitsu as a supplier of computer systems to U.S. industry.

- Fujitsu should capitalize on its inherent strengths when formulating a plan for marketing in the U.S. These are:

  - Wide-range product line and capability of developing new products.

  - Great financial resources.

  - International orientation.

  - Part of a nation experiencing the greatest productivity improvement among all nations worldwide over the past ten years.

- Fujitsu needs to develop an in-depth strategy for marketing small computer systems to those recommended industry sectors and application opportunities having the greatest potential in the 1980-1985 timeframe. The analysis should include:

  - A search for potential joint ventures in the software, distribution, and maintenance functional areas.

  - The establishment of a field service organization incorporating a software maintenance and remote diagnostic capability.

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- The initiation of a substantial public relations and promotional program for Fujitsu's products and other capabilities.

• Suggested product opportunities for further research include:

- CAD/CAM.

- Materials requirement planning.

- Specialized business applications.

- Automatic programming.

III FORECASTING ALL VENDOR POTENTIALS AND
SHIPMENTS FOR SMALL COMPUTER SYSTEMS
IN THE U.S.

III   FORECASTING ALL VENDOR POTENTIALS AND SHIPMENTS OF SMALL
       COMPUTER SYSTEMS IN THE U.S.

A.   DETERMINING MARKET POTENTIAL

- INPUT determined that competition, price/performance improvements, industry specialization, and application concentration would equally impact, and result in dramatic growth to, all three classes of computer systems markets. Therefore, an analysis of the potential and actual shipments in the U.S. market for these computer systems was performed by industry sector. The government sector, which INPUT estimates to be about 15% of the market, was excluded from the study due to time limitations and minimum opportunity potential for Fujitsu.

- The U.S. economy was divided into 12 industry sectors, as shown in Exhibit III-1. Employment statistics are based upon the 1976 County Business Patterns report issued by the U.S. Department of Commerce. These statistics cover establishments of various sizes and are segmented by industry type. INPUT believes that in 1980 an establishment of 20 or more employees can at least justify the acquisition of the minimum-priced ($20,000) computer system covered in this study. A constant 2% annual growth rate in the labor force for each industry sector was used to increase the forecasted work population to the 1980 and 1985 levels shown in Exhibit III-1, columns A and B.

EXHIBIT III-I

POTENTIAL: TOTAL SMALL COMPUTER SYSTEM SHIPMENTS IN THE U.S. (EXCLUDING GOVERNMENT), 1980 AND 1985

INDUSTRY SECTOR	EMPLOYEES IN ESTABLISHMENTS OF >20 EMPLOYEES (IN MILLIONS)		NUMBER OF EMPLOYEES PER SMALL SYSTEM		POTENTIAL SMALL SYSTEMS SHIPMENTS IN U.S. (K UNITS)	
	A	B	C	D	E	F
	1980	1985	1980	1985	1980	1985
DISCRETE MANUFACTURING	11.0	12.2	30	18	360	680
PROCESS MANUFACTURING	8.0	8.9	30	18	260	495
TRANSPORTATION	1.7	1.9	30	18	55	105
UTILITIES	1.9	2.1	40	25	50	85
BANKING/ FINANCE	1.3	1.4	40	20	35	70
INSURANCE	1.1	1.2	40	20	28	60
MEDICAL	3.5	3.9	40	25	88	155
EDUCATION	0.9	1.0	40	25	23	40
RETAIL	8.1	8.9	40	25	200	360
WHOLESALE	2.9	3.2	35	20	83	160
SERVICES*	5.0	5.5	45	28	110	200
OTHER**	4.2	4.7	90	55	45	85
TOTAL	49.6	54.9	-	-	1,337	2,495

*e.g., HEALTH, LEGAL, HOTEL, AUTO, etc.
**i.e., AGRICULTURE, MINING, CONSTRUCTION

KEY: $E = A \div C$; $F = B \div D$

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- To derive the figures listed in columns C and D of Exhibit III-1 as the justifiable number of employees utilizing the smallest (Class A) computer system, consideration was given to the following variables:

    - Wage rate trends per industry.

    - System price/performance improvements.

    - Competitive requirements.

    - Availability of industry-specialized software.

    - Type of industry (e.g., manufacturing, service, etc.).

    - Density of working population (i.e., employees per square foot).

    - Government regulations and constraints.

- Industries having high wage rates and heavily concentrated work forces can benefit from computer systems to a greater degree than others (e.g., discrete manufacturing versus agriculture).

- The potential number of small systems calculated for 1980 is 1.3 million units (column A divided by column B), expanding to 2.5 million units by 1985, yielding an average annual growth rate of 13% based upon the following assumptions during the forecast period:

    - Price/performance characteristics of systems increase annually while labor costs continue to rise.

    - Marketing of product offerings expands and improves.

    - User familiarity with, and desire to own, computer systems continues to increase.

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- Management continues to focus attention on profit improvement and cash flow needs.

• The U.S. market for small computer systems shipped to users in the U.S. for 1980 is estimated at 110,000 units (excluding government) and is expected to grow at a 28% average annual rate through 1985, at which time shipments of 370,000 units are forecasted.

• Exhibit III-2 portrays potential market estimates with forecasted shipments of small systems in the U.S. through 1985. It indicates that this market is approaching a saturation level in the 1985 timeframe, after which time its rate of growth will more closely approximate that of larger mainframe systems'.

- After-sale markets of add-on and larger-capability peripherals, product maintenance, and software enhancements will continue to contribute to the revenue stream for the installed system base.

- The replacement market for small computer systems will continue to expand as price/performance capabilities improve.

B. SHIPMENTS OF SMALL COMPUTER SYSTEMS

• The unit shipment growth for all classes (A, B, and C) of small computer systems in the U.S. will expand from 110,000 to 370,000 units during the 1980-1985 timeframe, representing an increase in shipment value from $4.4 billion to $18.5 billion (AAGR of 33%).

- Class A systems are priced between $20,000 and $49,000.

- Class B systems are priced between $50,000 and $99,000.

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EXHIBIT III-2

U.S. SMALL COMPUTER SYSTEMS' NEW MARKET
PENETRATION EXCLUDING GOVERNMENT AGENCIES
(FEDERAL, STATE, CITY) FOR ALL CLASSES
(K UNITS)

YEAR	(A) MARKET POTENTIAL	(B) SHIPMENTS	(C) INSTALLED BASE	(D) UNFILLED NEED (A−C)	(E) MARKET PENETRATION PERCENT (B ÷ D)
1980	1,350	110	480	870	13%
1981	1,525	135	615	910	15
1982	1,725	175	790	935	19
1983	1,950	225	1,015	935	24
1984	2,200	290	1,305	895	32
1985	2,500	370	1,675	825	45

- Class C systems are priced between $100,000 and $200,000.

• Exhibit III-3 shows the estimated split between the three classes of systems relating to the unit and value of shipments forecasted for 1980 and 1985.

    - The most dramatic growth (AAGR of 41%) is represented by the Class C system group, with CAD/CAM in the manufacturing industry being a prime factor in such growth.

• The average unit system cost will tend to increase as vendors provide more capability, storage, peripherals, and support to the user.

C.   DIVIDING THE MARKET BY APPLICATION AND INDUSTRY SECTOR

• Exhibit III-4 apportions the 1980 and 1985 projected markets by applications sector.

    - Instrument process control.

    - Engineering and scientific.

    - CAD/CAM.

    - Communications controller.

    - General business.

• Three of these sectors are of particular interest.

EXHIBIT III-3

SEGMENTATION OF SMALL COMPUTER

SYSTEM SHIPMENTS BY CLASS GROUPING

| CLASS | PRICE RANGE ($THOUSAND) | SHIPMENTS | | | | AAGR (PERCENT) | |
| | | 1980 | | 1985 | | | |
		UNITS (THOUSAND)	$ BILLION	UNITS (THOUSAND)	$ BILLION	UNITS	REVENUE
A	$20-49	80	$2.4	250	$ 8.5	26%	29%
B	$50-99	20	1.0	75	4.5	30	35
C	$100-200	10	1.0	45	5.5	35	41
TOTAL	-	110	$4.4	370	$18.5	27%	33%

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EXHIBIT III-4

SMALL COMPUTER SYSTEM
SHIPMENTS IN THE U.S. FOR
ALL CLASSES BY APPLICATION,
1980 AND 1985

APPLICA-TION	1980		1985	
	UNITS (THOUSAND)	$ BILLION	UNITS (THOUSAND)	$ BILLION
INSTRUMENT AND PRO-CESS CON-TROL	16-20	$0.5	30-36	$1.0
ENGINEERING AND SCIENTIFIC	10-12	0.5	22-24	1.5
CAD/CAM	3-4	0.5	10-15	2.5
COMMUNI-CATIONS CONTROLLER	6-10	0.4	18-20	1.8
GENERAL BUSINESS	65-75	2.5	265-300	11.7
TOTAL	110	$4.4	370	$18.5

- The CAD/CAM market has just begun to evolve due to the current worldwide concern for increased productivity throughout the product design community. With the increased cost of every type of product design, a 40% AAGR is readily attainable.

- Within the general business category, representing over 60% of the total, industry specialization will continue to play a more dominant role, as application packages continue to be developed and expanded with additional capabilities.

- Process control and energy conservation systems will continue to expand across all industries.

• Exhibit III-5 segments the 1980 and 1985 small computer systems market by the 12 industry groups discussed earlier. These industries are compiled into six major categories as presented in Exhibit III-6. Some of the more important conclusions that result from analyzing this chart are:

- Manufacturing and distribution will continue to represent over two-thirds of small computer shipments throughout the 1980-1985 timeframe.

- The average system cost in the manufacturing group will dramatically increase as a result of the burgeoning CAD/CAM market and the greater system cost associated with that capability.

• Exhibit III-7 portrays a matrix of the six industry groups compared against the five application areas addressed in this study. Each cell within the matrix represents a market opportunity for small computer systems. INPUT has rated these by assigning zero, one, two, or three asterisk(s), reflecting the relative growth rate of that particular market during the forecast period of 1980-1985.

• As expected, general business remains the application representing almost two-thirds of the growth during the forecast period.

EXHIBIT III-5

SMALL COMPUTER SYSTEM SHIPMENTS
IN THE U.S. FOR ALL CLASSES BY INDUSTRY SECTOR
1980-1985

INDUSTRY SECTOR	1980		1985	
	UNITS (THOUSAND)	($ BILLION)	UNITS (THOUSAND)	($ BILLION)
DISCRETE MANUFACTURING	24-25	$0.80-1.20	75-80	$4.40-4.60
PROCESS MANUFACTURING	18-22	0.80-1.20	70-75	4.20-4.40
TRANSPORTATION	4-5	0.10-0.20	12-15	0.50-0.80
UTILITIES	3-4	0.10-10.15	10-14	0.40-0.60
BANKING/FINANCE	3-4	0.12-0.16	10-14	0.45-0.60
INSURANCE	2-3	0.08-0.12	7-10	0.25-0.40
MEDICAL	2-4	0.08-0.16	8-10	0.25-0.40
EDUCATION	2-4	0.50-0.65	7-10	0.25-0.40
RETAIL	12-16	0.50-0.65	50-55	2.0-2.3
WHOLESALE	8-10	0.32-0.40	28-35	1.2-1.4
SERVICES	9-11	0.35-0.45	40-50	1.8-2.2
OTHER	8-10	0.30-0.30	35-40	1.6-1.8
TOTAL	110	$4.40	370	$18.50

EXHIBIT III-6

SMALL COMPUTER SYSTEM SHIPMENTS
IN THE U.S. FOR ALL CLASSES BY INDUSTRY
GROUP, 1980 AND 1985

INDUSTRY GROUP	1980		1985	
	UNITS (THOUSAND)	$ BILLION	UNITS (THOUSAND)	$ BILLION
MANUFACTURING	42	$1.95	150	$ 8.80
DISTRIBUTION	28	0.95	84	3.40
TRANSPORTATION AND UTILITIES	8	0.26	25	1.10
FINANCE AND INSURANCE	5	0.24	21	0.85
SERVICES	16	0.65	55	1.70
OTHER	11	0.35	35	2.65
TOTAL	110	$4.40	370	$18.50

EXHIBIT III-7

GROWTH MATRIX OF SMALL COMPUTER SYSTEM SHIPMENTS IN THE U.S.

BY INDUSTRY AND APPLICATION, 1980 TO 1985

INDUSTRY GROUP	INSTRUMENT AND PROCESS CONTROL	ENGINEERING AND SCIENTIFIC	CAD/CAM	COMMUNICATION CONTROL	GENERAL BUSINESS	TOTAL $ BILLION (PERCENT)
MANUFACTURING	**	*	***	***	***	$6.8 (350%)
DISTRIBUTION				R: ***(1) W: *	**	$2.5 (260%)
TRANSPORTA-TION/AND UTILITIES	*	*	**	*	**	$0.8 (310%)
FINANCE AND INSURANCE				***	**	$0.6 (260%)
SERVICES		*		**	**	$2.0 (310%)
OTHER		*		*	***	$1.3 (350%)
TOTAL ($ BILLION)	$0.5 (100%)	$1.0 (200%)	$2.0 (400%)	$1.4 (350%)	$9.2 (370%)	$14.0 (320%)

AAGR = 33%

KEY: * : < 250% GROWTH
     ** : 250 - 350% GROWTH
     *** : > 350% GROWTH

(1) RETAIL (R) REPRESENTS A HIGH POTENTIAL, WHERE AS WHOLESALE (W) WILL HAVE A SLOW MOVEMENT REQUIREMENT INTO THE USES OF COMMUNICATION NETWORKS

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- Of particular interest are the opportunities represented by industry-specialized applications, which INPUT forecasts to be the largest-growing portion of the general business application area.

- Class A and B systems dominate the general business application category.

• Large (Class C) computer systems have the highest application percentage growth potential in the CAD/CAM and scientific application areas.

- Forecasts predict that the fastest-growing market, spurred by the drive for increased productivity, is for CAD/CAM, growing at a rate of 40-45% annually from 1980-1985.

D. PLANNING FOR THE INSTALLATION OF SMALL COMPUTER SYSTEMS

• Most respondents of the INPUT Annual User Panel Survey indicated that anticipated 1980 installations will be additional units, rather than replacements or first installations.

• Reported applications tended to be more specialized and less "all-purpose" than in the past. Examples include:

- Energy control.

- Cash accounting.

- Inventory control.

- Billing.

- Order entry.

- Shop-floor control.

E. THE MARKET FOR SMALL COMPUTER SYSTEMS PRICED LESS THAN $20,000

- Although this project was not designed to investigate the small computer system market represented by a price of less than $20,000 per unit, no analysis would be complete without some mention of this burgeoning market.

- Our research for Class A, B, and C small computer systems was based upon the premise that an establishment of 20 or more employees has the potential to justify the purchase of such a system.

- Exhibit III-8 shows the division of employees in the U.S. sectored by establishment size. Over 25% of all employees will work in establishments having fewer than 20 people employed during the timeframe covered in this study.

- INPUT research determined that $200 is the average EDP expense per employee per year in small establishments.

  - Therefore, an establishment of five employees will spend $1,000/year on EDP.

  - Currently, the price of the smallest business computer system is now less than $5,000, with an annual cost of about $1,500 for a 60-month, full-payout lease, permitting the purchase to be in the realm of a five-person establishment within three years, when the price is halved.

- Considering a 30-35% AAGR in computer system price/performance over the next five years, the potential market for small business systems priced at less than $20,000 will include the more than 1.2 million establishments employing between 13 and 15 million people during the 1980-1985 time period.

- These small systems will continue their high shipping rate, even when saturation of the potential market for Class A, B, and C systems approaches in the 1985 timeframe.

EXHIBIT III-8

FORECASTS OF THE NUMBER OF ESTABLISHMENTS AND
EMPLOYEES IN THE U.S., 1980 AND 1985

NUMBER OF EMPLOYEES PER ESTABLISHMENT	NUMBER OF ESTABLISHMENTS IN GROUP (THOUSAND)	NUMBER OF EMPLOYEES IN GROUP (THOUSAND)	
		1980	1985
1-4	2,410	5,000	5,600
5-19	1,250	13,150	14,600
≥ 20	490	49,500	54,975
TOTAL	4,150	67,650	75,175

IV DRIVING FORCES

IV   DRIVING FORCES

● There are a number of powerful driving forces certain to impact the small computer system market during the period 1980-1985 which will provide substantial opportunities for business development.

A.   INFLATION

● With worldwide inflation certain to remain within the 8-20% annual rate during our forecast period, the replacement of labor cost with capital equipment will continue to be an attractive alternative for the prudent business executive. This opportunity is especially attractive when considering that, through technological advancement, the price/performance of computer equipment will be such that the buying price of systems will decrease in current dollars as labor costs and salaries continue to rise.

B.   PRODUCTIVITY

● The competitive drive to survive will force companies of all sizes to decrease their operating costs through improved efficiencies. As discussed in the previous section, the impetus to replace high labor costs with effective capital equipment will become a continually more attractive alternative over the 1980-1985 time period.

C.   ENERGY

●   The energy crunch, which promises to become more acute in the coming years, will open new markets for process controls and monitoring. Again, the rise in operating and resource costs compared to improvement in computer system price/performance will offer a number of new product and market opportunities.

D.   SKILLED PERSONNEL AVAILABILITY

●   The lack of skilled personnel is of continued and growing concern throughout all government and industry operations. The demand for such people resources will continue to be spurred, but intelligence-based products may help minimize the requirement for skilled personnel.

E.   TECHNOLOGY

●   Technology will certainly continue to drive the cost of manufacturing down, permitting more powerful equipment to perform more difficult tasks at a lower price. Greater use of the more reliable and lower-priced semiconductor devices will be a major force in the continuation of this trend.

F.   GOVERNMENT CONTROLS AND REGULATIONS

●   There is a strong likelihood that government will require more, rather than less, reporting and data concerning personnel, energy use, safety, resources and materials used, imports/exports, cash flow, and other information requests from companies of every size and type. Companies will therefore be required to submit reports in accordance with such new demands and requirements.

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G.   COMMUNICATIONS COSTS

- Communications costs are not expected to decrease over the next few years, while EDP network systems are expected to grow. Therefore the need for distributed data processing (DDP) systems and small, free-standing computer stations will proliferate.

H.   PRODUCT MAINTENANCE

- The general concern over maintenance problems in far-flung business locations has been the largest deterrent to the growth of DDP. As users' confidence in both system hardware and manufacturers' abilities to maintain this hardware increases, the growth of DDP and small computer installations will continue to expand.

V DETERMINING THE MARKET FOR DISTRIBUTED DATA PROCESSING (DDP)

V   DETERMINING THE MARKET FOR DISTRIBUTED DATA PROCESSING (DDP)

A.   DIMENSIONING THE MARKET

- INPUT has determined that the growth of DDP would affect the Class A small computer system market to a far greater degree than the larger Class B and C systems markets.

- The forecast for small computer systems (Exhibit III-2) called for an increase from 110,000 U.S. system shipments in 1980, to 370,000 shipments in 1985, for an average annual growth rate of 27%.

- Class A systems, with probably less than 3,000 units entering the DDP market in 1980, is forecasted to expand shipment to a 50,000-unit level by 1985. Exhibit V-1 shows a comparison of the other system classes indicating a skewing towards the Class A units, with the other system shipments as follows:

  - Class B: less than 15,000 DDP shipments in 1985.

  - Class C: less than 25,000 DDP shipments in 1985.

EXHIBIT V-1

U.S. SMALL COMPUTER SYSTEM SHIPMENTS
AND PERCENTAGE OF THOSE SYSTEMS INVOLVED
IN DDP

SYSTEM CLASS	YEAR			
	1980		1985	
	SYSTEM SHIPMENTS (THOUSAND)	PERCENT IN DDP ENVIRONMENT	SYSTEM SHIPMENTS (THOUSAND)	PERCENT IN DDP ENVIORNMENT
A	80	5-10%	250	15-30%
B	20	<5	75	10-20
C	10	10-15	45	40-50

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B.   DETERMINING DDP MARKET PENETRATION BY INDUSTRY SECTOR

- INPUT determined that users frequently exhibit limited quantitative know-ledge regarding their long-term plans as it relates to DDP planning. INPUT developed an index to forecast the proportion of Class A systems installed in a DDP environment. Users' responses varied by industry as an indication of willingness or interest in utilizing the DDP concept. Exhibit V-2 ranks these user perceptions or plans by industry.

    - Discrete manufacturing will represent over 35% of DDP shipments in 1985, remaining the largest DDP user among the industry sectors.

    - The highest DDP AAGR is forecast for retail, with a rate exceeding 50% in the 1980-1985 timeframe.

    - Banking and finance will be the industry sector having the greatest propensity towards DDP participation.

C.   DETERMINING TOTAL DDP SHIPMENTS FOR CLASS A, B, AND C SYSTEMS

- INPUT forecasts that during the 1980-1985 timeframe the value of U.S. shipments for all classes (A, B, and C) of systems will increase at 27% AAGR; and of those units shipped, approximately 9,000 in 1980 and 70,000 in 1985 will be involved at some time in a DDP function (an AAGR of 50%).

- Class A systems will usually act as nodes in a DDP environment, while Class Cs will operate more often as hosts, in addition to performing other compu-tational tasks. The B group may perform in computing both assignments as either a host or a node.

EXHIBIT V-2

RANK ORDERING OF DDP SENSITIVITY BY INDUSTRY,
1980 AND 1985
(1 HIGHEST, 12 LOWEST)

INDUSTRY SECTOR	1980	1985
DISCRETE MANUFACTURING	3	4
PROCESS MANUFACTURING	4	2
TRANSPORTATION	11	11
UTILITIES	10	9
BANKING/FINANCE	2	1
INSURANCE	5	5
MEDICAL	9	10
EDUCATION	1	6
RETAIL	6	3
WHOLESALE	12	12
SERVICES	7	7
OTHER	8	8

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- Class A systems will impact Class B and C systems sales in the same manner as microcomputers will compete with Class A computers in the 1980-1985 timeframe.

- Class A systems will continue to proliferate among first-time computer users, thereby tending to maintain a low DDP saturation level.

D.   KEY ARCHITECTURAL AND APPLICATIONS ISSUES

- INPUT believes that DDP is still early in its evolutionary cycle, with most existing or planned installations functioning in a star configuration.

- Both the banking and discrete manufacturing industries exhibited a high incidence of heirarchical networks due to their more-advanced state of DDP development.

- Limited evidence existed of ring structures (with or without hosts), although it is INPUT's belief that future applications for such ring structures will evolve in selected market areas.

- There appears to be a lack of both user sophistication and vendor product offerings related to network architecture. DP managers need assistance in the communications area.

- Applications currently performed by respondents placed heavy emphasis on traditional business accounting functions with close correlation between host and remote responses.

INPUT

VI APPLICATIONS SOFTWARE TRENDS FOR
SMALL COMPUTER SYSTEMS, 1980-1985

VI APPLICATIONS SOFTWARE TRENDS FOR SMALL COMPUTER SYSTEMS, 1980-1985

A. A DISCUSSION OF INDUSTRY-SPECIALIZED APPLICATIONS SOFTWARE BY INDUSTRY GROUP

- A number of specialized applications software opportunities will be developed in response to the issues and driving forces anticipated for the 1980-1985 timeframe. These applications will result from a definite need by the user, and will be incremental to the general business requirement application anticipated to grow at a 20-30% annual rate. The following list represents some of these expected opportunities, segregated by industry group.

- Manufacturing.

  - The expanded use of CAD/CAM as a result of management's need to combat spiralling costs through improved efficiencies and productivity, is undoubtedly one of the fastest growing market opportunities for a small computer systems vendor.

  - The ever-growing need to maintain tighter asset management and control demands more fool-proof methods for managing and controlling raw materials, work in progress, and finished goods inventory. With the prime rate hovering at 20%, the cost of carrying inventory is currently at a 30-40% annual rate for manufacturers.

-   To comply with the increasing requirements for government reporting and recordkeeping for safety, toxic materials disposal, OSHA, and other personnel protection measures, a growing need will arise during the mid-1980s for systems aiding businesses.

-   Transportation.

    -   Routing prioritization for truck transport planning will be needed so as to minimize cost and elapsed transportation time.

    -   Consumer-oriented transportation scheduling, reservations, and inquiry in a real-time DDP environment will also be in demand.

-   Utilities.

    -   Automatic polling and billing of customers will be needed, as well as energy control and conservation systems.

-   Insurance.

    -   Rate and agent inquiry capability via a DDP network structured around a maintained data base will be used to offload large mainframes and reduce communications costs.

-   Medical.

    -   With rising medical and hospital costs, improved patient diagnostic techniques are needed so as to maximize out-patient programs. This involves testing, analysis, and prioritization, as well as business-oriented applications (e.g., reservations, billing, etc.).

•   Distribution.

   -    Inventory turnover is at least as critical to the distribution industry as
        it is to the manufacturing industry. Therefore, there will be an
        increasingly stronger requirement for DDP inventory management and
        control systems.

•   Other industries.

   -    Auto repair data base development for insurance requirements will be
        needed.

   -    Construction management will need an on-site program control
        employing ruggedized small computer systems.

   -    Agricultural analysis and planning systems for optimizing farm oper-
        ations (what, when, and where to plant and harvest) will be needed in
        addition to profit projections and in-favor-of programs.

B.   SOURCES OF APPLICATIONS SOFTWARE PRODUCTS IN 1985

•   As shown in Exhibit VI-1, the most dramatic change in sourcing application
     software during the 1980-1985 timeframe will be utilizing computers for
     generating such products (referred to as "automatic").   The procedure
     employed will be through instructional techniques.

   -    In order to identify their applications software requirements, users will
        respond to specific questions concerning applications specifications and
        appropriate keyboard input information, since the application is
        constructed around the parameters and specifications provided.

•   The continuing shortage of skilled programmers, coupled with spiralling costs
     and wages, will provide the stimulus for accelerating the development of
     automated applications software.

EXHIBIT VI-1

MAJOR SOURCES FOR DEVELOPING
APPLICATIONS SOFTWARE, 1980 AND 1985

SOURCE OF DEVELOPMENT	1980 (%)	1985 (%)
IN-HOUSE	60%	50%
VENDOR	40	40
"AUTOMATIC"	–	10
TOTAL	100%	100%

- In 1985, INPUT believes that vendor-supplied applications software will be developed by the following sources:

-	Turnkey/system houses	25%
-	Hardware manufacturers	20
-	Remote computing services companies	15
-	Software vendors	15
-	Professional services firms	12
-	Other sources	13
		100%

VII PRODUCT MAINTENANCE ISSUES

VII   PRODUCT MAINTENANCE ISSUES

A.   IMPORTANCE OF A PRODUCT MAINTENANCE CAPABILITY

- INPUT determined through extensive research that a key factor end users consider of extreme importance when evaluating the purchase of information processing equipment is the demonstrable post-sales support and maintenance for both software and hardware.

- The importance of this post-sales support and maintenance will be of increasing value in successfully marketing small computer systems to a sophisticated but first-time end user of data processing equipment. Even if the product is marketed to OEMs, their demands and expectations of quality in both hardware and software maintenance will be equal to or greater than the demands of the first-time end user.

B.   FIELD SERVICE ORGANIZATIONS - 1985

- By 1985, it is expected that the field service organizations that Fujitsu will be required to compete against will be different from the current structure of the companies in the U.S. today. These differences will be dictated by both the types of products they will be required to maintain and the methods through which that service is delivered to the customer base. The strategic issues to be considered are outlined below.

I. ORGANIZATION OF THE MAINTENANCE WORKFORCE

- U.S. companies are structuring their maintenance workforce into larger, centralized units either at a district or national level. This trend toward centralization is dictated by both the poor economics of individual service calls and the ability of the data processing and telecommunications technology to effect diagnosis and support without the traditional physical presence of a field engineer at the customer location.

- The implementation of systems support centers and remote diagnostic centers at regional and national locations are appearing in significant numbers and will be commonplace by 1985. Important companies that have already established such capabilities are:

  - Amdahl.

  - Basic Time Sharing.

  - Control Data Corporation.

  - Data General.

  - DEC.

  - Four Phase.

  - IBM.

  - Tandem.

  - TRW.

- It is expected that all companies with annual revenues of over $50 million will have these types of capabilities by 1985.

- Those companies operating such centralized facilities will have continued an evolution of remote diagnostics that will have reached maturity by 1985.

2. USER INVOLVEMENT IN MAINTENANCE ACTIVITIES

- By 1985, users will be playing an active role in the diagnosis and repair of small business products. This will occur in one or both of the following ways:

    - Users will assume responsibility for the replacement of modules under the direction of one of the remote centers discussed above.

    - Users will be conditioned to return products to depots for repair when it is not economical for the vendor to repair it at the customer location.

- IBM has already established this principle with the introduction of the 3101 series of terminals which must be returned to depots for repair.

3. AVAILABILITY OF MAINTENANCE PERSONNEL

- The availability of qualified field service personnel will have diminished from its current critical position (current shortfall of about 15%) to an excess capacity. This surplus of field engineering personnel will be primarily due to:

    - Centralization of field service workforces.

    - Increased reliability of the equipment base, necessitating fewer service calls.

    - Involvement of users in the maintenance activity.

- However, the surplus personnel available will be overqualified and overpaid for the type of work that must be accomplished in field service organizations.

4. SOFTWARE MAINTENANCE

- The maintenance of software is differentiated from hardware maintenance due to the non-complementary, personnel skill requirements. Software maintenance and new product release will be managed through a parallel organization within the field service organization.

- Attempts to assign the responsibility for both hardware and software maintenance to an individual person or district office may result in increased training costs and potentially ineffective organizational elements.

    - Hardware maintenance personnel will not have the basic skills necessary to perform these functions and will require extensive training.

    - U.S. firms who have tried this approach end up losing these personnel to software development organizations within either their existing company or the competition.

    - Since the demand for software personnel will continue to be heavier than the supply into the late 1980s, it will be extremely difficult or impossible to motivate these personnel to assume responsibility for hardware maintenance activities.

C. SERVICE CONTRACT ALTERNATIVES

- Within the U.S. small computer market, there are three types of service relationships that a customer can enter into with a vendor:

    - Customer-site (or on-site) maintenance.

    - Depot maintenance.

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- Time and material maintenance.

I. CUSTOMER-SITE MAINTENANCE

- The vendor provides all maintenance services at the customer's location, subject to a series of terms and conditions as contracted between the parties.

2. DEPOT MAINTENANCE

- This is identical to the customer-site maintenance agreement except that the customer is required to deliver the faulty unit to the specified depot for repair. However, there is some variation, with some vendors providing the pick-up and delivery of the faulty unit. Although this type of service relationship is limited to portable equipment, it does provide a reduction in maintenance costs of up to 20%.

- Depot maintenance is relatively new in the DP industry, since it is only in recent years that there has been enough portable equipment to make it feasible.

   - The industry recognizes that depot maintenance is cost effective. More and more companies are adopting it and its use can be considered a firm industry trend.

3. TIME AND MATERIAL MAINTENANCE (T&M)

- This type of service agreement has the most open structure of all the maintenance contracts. There is no agreement between the parties on the level of maintenance provided. When the customer's unit fails, the vendor provides maintenance for a previously-agreed-upon hourly rate and associated parts cost. Response to customers is usually not good, since a vendor will first service those customers with fixed-fee contracts while T&M customers are frequently handled on a time-available basis. Vendors usually try to discourage these types of maintenance relationships because they can result in very unhappy customers, even though T&M work is generally quite profitable.

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- While a few companies "hedge" their response time commitments on T&M contracts, many do not. In theory, this could cause legal responsibility problems for vendors who do make commitments but don't live up to them.

INP

VIII   DISTRIBUTION CHANNELS FOR SMALL COMPUTER SYSTEMS

VIII   DISTRIBUTION CHANNELS FOR SMALL COMPUTER SYSTEMS

- During the last few years there has been a significant trend toward the use of alternate distribution channels (other than computer manufacturers' sales forces) in selling computer systems.

- This trend is driven by:

    - The increasing cost of a sales call.

    - The lack of available qualified sales representatives.

    - The decreasing cost of a computer system.

    - A stronger emphasis on selling to small businesses.

    - The success of companies such as Digital Equipment Corporation and Tandy (Radio Shack) with their use of alternate distribution channels.

- During the next five years, computer manufacturers' direct sales staff will remain the key sales path for computer systems costing more than $50,000. However, computers in the $20,000-and-less price range will increasingly be sold through other channels.

- A description of changes expected by 1985 are discussed in this section.

A.   PURCHASE POINTS FOR COMPUTER SYSTEMS

● There is a wide variety of both organizations purchasing computers and individuals doing the actual purchasing. To a great extent this is one of the driving forces which are causing the development of alternate distribution channels. These organizations are listed in Exhibit VIII-1.

● All of the first three categories of organizations shown in Exhibit VIII-1 are different portions of large companies. These portions buy different categories of computers in different ways, and they have to be sold to in different ways.

  - EDP managers at corporate headquarters purchase large amounts of equipment. They are knowledgeable and used to being called on by manufacturers' sales representatives. If at all possible, this direct sales practice should be continued at major accounts.

  - On the other hand, individual executives who buy computers costing $20,000 and less are very different customers. They are less knowledgeable than the EDP manager and the amount of money they have to spend is considerably smaller. They can be reached by:

    . Direct sales representatives.

    . Distributors.

    . System houses.

    . Store-front operations.

  - The sale may or may not have to be coordinated with the EDP department; however, the individual user will assist in this coordination.

EXHIBIT VIII-1

ORGANIZATIONS PURCHASING SMALL
COMPUTER SYSTEMS (CLASSES A, B, AND C)

DESCRIPTION	NUMBER OF LOCATIONS OR POTENTIAL USERS	PRODUCT DISTRIBUTED (CLASS SYSTEM)	PURCHASE POINT
CORPORATE OR DIVISION HEADQUARTERS	3,000-5,000 LOCATIONS	A, B, C	EDP MANAGER
CORPORATE OR DIVISION HEADQUARTERS	1 MILLION USERS	A	PROFESSIONAL OR EXECUTIVE
LARGE COMPANY BRANCHES, <500 EMPLOYEES	200,000 LOCATIONS	A, B, C	BRANCH OR CORPORATE LEVEL
INDEPENDENT ENTERPRISES, 100-499 EMPLOYEES	75,000 LOCATIONS	A, B, C	EDP MANAGER OR EXECUTIVE
INDEPENDENT ENTERPRISES, 20-99 EMPLOYEES	400,000 LOCATIONS	A, B	EXECUTIVE
INDEPENDENT ENTERPISES, 1-19 EMPLOYEES	4 MILLION LOCATIONS	< A	EXECUTIVE

- Branches of large companies (the third category) vary considerably in both size and freedom to purchase computers without corporate head-quarter approval.

- The larger branches, which can utilize $200,000 systems, are best served with the more sophisticated sales channels such as manufacturers' direct sales staff and computer services companies. The smaller branches which utilize $20,000-50,000 computers can be reached by the full range of alternate distribution channels.

- Independent enterprises of under 500 employees represent about 99% of all U.S. establishments and 75% of all U.S. employees. They should be approached by the various distribution channels according to company size.

  - Small businesses of 100-499 employees can utilize $100,000-200,000 computer systems. These systems are best sold by manufacturers' direct sales staff.

  - Small enterprises of 1-19 employees are candidates for $20,000 systems and can be approached by a range of alternate distribution channels.

B.   DISTRIBUTION CHANNELS OF 1980

- There are many types of alternate distribution channels which are now being used to reach the computer users discussed in the preceding section. These distribution channels include:

  - Manufacturers' direct sales staff.

  - System houses.

  - Hardware integrators.

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- Agents and dealers.

- Computer services vendors.

- Store-front computer sales operations.

    . Independently owned.

    . Owned by a major vendor.

- Other distribution channels which are not suitable for $20,000 (and up) computer systems sales include:

    - Mail order.

    - Department stores.

    - Electronic hobby stores.

    - Franchises.

- Manufacturers' direct sales representatives are currently the primary distribution channel for computer equipment systems costing over $20,000.

    - Advantages include:

        . Knowledge of the product.

        . Dedication to the product.

        . Control by the manufacturer.

- Disadvantages include:

  . Cost.

  . Scarcity of qualified sales representatives.

  . Lack of industry-specific knowledge.

- Manufacturers' direct sales staff can sell to all classes of users. However, they are best at selling to the EDP manager, large branches, and large independent enterprises.

● System houses and hardware integrators are an important distribution channel because of their industry-specialized knowledge and their capability of modifying hardware and software to meet the users' needs. There are about 3,500 of these in the United States.

- Advantages of these channels are:

  . Industry-specialized knowledge.

  . Often the only way of having systems customized for the user.

  . Contacts which manufacturers' direct sales representatives do not have.

  . Operations in locations and with customers not economically reached by manufacturers' direct sales staff.

- Disadvantages of these channels are:

  . They receive revenue which is not passed on to the manufacturer.

  . They may also distribute competing brands, and may switch to different suppliers.

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- They may be "cash poor" at times.

- They require support.

- System houses and hardware integrators are best used for distributing $20,000-50,000 computer systems to independent enterprises and branches of large companies.

- They may require assistance when selling to non-EDP executives at large-company headquarters.

- Agents and dealers are essentially sales representatives who do not work for the computer manufacturer. They may have been previously employed by a large computer manufacturer and will usually have a sophisticated sales background.

- Their advantages include:

- Sales coverage in geographical areas which the manufacturer cannot cover.

- Possibility of unique contacts.

- Relatively low cost.

- Their disadvantages include:

- Lack of loyalty to the computer manufacturer.

- Inability to provide modifications to software and hardware.

- Requirements for support.

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- Agents and dealers are best used to sell the lower range of computer systems to independent small businesses.

● Computer services vendors, of which there are about 2,500 in the U.S., are known for their knowledge of user needs, software skills, and sales strengths.

   - Advantages of using computer services vendors as a distribution channel area include:

      . Software and industry knowledge.

      . Sales strength.

      . Customer base.

   - Disadvantages include:

      . They may require such a large discount that the venture is of minimal profitability to the computer manufacturer.

   - Computer services companies are becoming very interested in distributing hardware as well as services. They can be best used to sell computers to their existing customers, who are generally executives at corporate headquarters, large branches, or larger individual enterprises. Computer services companies can sell equipment in all price ranges.

● Store-front computer sales operations have received a great deal of publicity recently. They use sales staff operating from the store, and will (if owned by a computer manufacturer) be used to supplement direct sales representatives and other distribution channels.

INPL

- Advantages of store-front computer sales operations are:

  - They can efficiently find and sell computers to users who do not ask a sales representative to call and are not normally called upon.

  - They provide a high level of visibility for the computer brands they sell.

  - They have advantages similar to other distributors'.

- Disadvantages are:

  - They require support and training.

  - They handle multiple brands if independent.

- Store-front computer sales operations are best used to sell computers at the low end of the price range to:

  - Small companies.

  - Small branches of large companies.

  - Executives at corporate headquarters.

C.   CHANGES IN TECHNIQUES OF DISTRIBUTION EXPECTED BY 1985

- The main changes which will occur in the use of distribution channels by 1985 are:

  - An increased use of alternate distribution channels by major computer manufacturers.

INPUT

- A trend toward the use of distribution techniques which are similar to those used by the non-computer industry.

● Despite these changes, direct sales staff employed by manufacturers of computers will still be the major distribution channel for computers in the $50,000 to $200,000 price range.

- System houses and hardware integrators will become a more important distribution channel because the importance of applications programs will increase.

    . Manufacturers' direct sales staff will utilize system houses to adapt computer systems and programs for their own customers.

    . The growing numbers of new and unsophisticated computer users will require additional help from system houses, whose revenues will increase as a result.

- Agents and dealers will become more important in sales of computers to markets which are inefficient for manufacturers' direct sales staff to reach, such as:

    . Geographically separated markets (e.g., smaller cities).

    . Very unique markets in specific industries.

- Computer services companies will increase in importance as distribution channels because they will choose to use their expertise to act as distribution channels for computers and because they have extensive existing customer bases.

- Store-front sales operations will become a much more important channel of distribution.

- Major U.S. computer vendors will increase their use of this distribution channel as they compete with each other.

- The line of demarcation will blur between sales offices, dealerships, and store-front sales operations.

- In general, major end user computer manufacturers such as IBM and Honeywell will increase their use of alternate distribution channels to reach new customers when marketing the new, smaller computer systems currently under development.

  - However, they will still keep their existing distribution channels (mostly direct sales staff) to sell their existing products.

- Minicomputer and microcomputer vendors who previously marketed products solely to OEMS, but are now developing end user systems, will utilize alternate distribution channels. They cannot develop a direct sales force rapidly enough to meet the demand for small systems sold to small businesses, and thus will be forced to seek alternate channels of distribution.

IX EDP USER SPENDING PATTERNS

IX   EDP USER SPENDING PATTERNS

A.   EDP/COMMUNICATIONS SPENDING

- EDP/communications expenditures in the U.S. for 1979 approached $50 billion. This includes $30 billion for hardware, more than $9 billion for computer services and software, and $5 billion for communications. This reflects an overall growth of about 11% from 1978.

- With few exceptions, the EDP managers and executives interviewed for INPUT studies through March 1980 expressed little concern about the general economic condition. They do not anticipate a deep recession in 1980, and have not restricted their spending plans for this reason. However, those companies that experienced large increases in their EDP budgets last year are planning more modest increases of 10-15% this year.

  - The overall approach toward contingency planning in the event of a severe business downturn was one of cutting budgets if necessary; but half or more of the companies said their budgets would not be affected.

- The growth prospects for the industry as a whole do not seem to hinge as much on whether or not the world enters a recessionary phase as they do on continuing shortages of component parts and personnel.

- These factors plus the increasing cost of capital will combine to restrain overall growth to slightly above the general inflation rate; but specific sectors of the market, such as minicomputers, microcomputers, terminals, and miniperipherals, will grow much faster, at a 25-35% rate.

- Exhibit IX-1 shows that from the 535 respondents interviewed for the INPUT User Panel, manufacturing represents the largest budget for EDP, and the percentage growth for wholesale distribution is the most dramatic.

- Exhibit IX-2 verifies that the greatest portion of EDP budget growth as reported by users is in the small-computer/programmable-terminal category.

B.   INCREASED USE OF PURCHASED SOFTWARE PRODUCTS

- End users continue both to demand more functionality from existing applications and to create requirements for new applications at a rate faster than most EDP departments can deliver. One result is that almost half the EDP managers would gladly purchase applications software packages if they were suitable and available, as shown in Exhibit IX-3.

  - Since a cursory glance at the lists of applications desired by the separate industry sectors reveals many common applications, the conclusion must be that either the process for bringing buyers and sellers together is not adequate, or the process for defining requirements is deficient.

EXHIBIT IX-1

1979-1980 EDP BUDGET GROWTH FOR INPUT USER PANEL RESPONDENTS
WITH ANNUAL SALES OR ASSETS IN EXCESS OF $1 BILLION

INDUSTRY SECTOR	AVERAGE 1979 BUDGET ($ MILLION)	EXPECTED INCREASE (PERCENT)	AVERAGE 1980 BUDGET ($ MILLION)	INCREASE 1979-1980 ($ MILLION)
DISCRETE MANUFACTURING	$15.3	9.8%	$16.8	$1.5
PROCESS MANUFACTURING	18.6	14.4	21.3	2.7
TRANSPORTATION*	46.0*	10.0*	50.4	4.6*
UTILITIES	11.1	13.8	12.6	1.5
WHOLESALE DISTRIBUTION	6.4	27.5	8.1	1.7
RETAIL TRADE	8.4	8.8	9.1	0.7
BANKING AND FINANCE	3.3	13.8	3.7	0.4
INSURANCE	8.2	11.0	9.1	0.9
SERVICE AND OTHER	23.7	3.7	24.6	0.9
AVERAGE	$11.8	12.85%	$13.1	$1.3

SOURCE: INPUT EDP USER PANEL, 1979 (535 RESPONDENTS)

*SINGLE RESPONDENT, NOT INCLUDED IN TOTALS

EXHIBIT IX-2

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ANTICIPATED CHANGES IN EDP BUDGETS
FOR RESPONDENTS IN ALL INDUSTRIES

BUDGET CATEGORY	PERCENT OF TOTAL EDP BUDGET			INCREASE (DECREASE) 1979-1981
	1979	1980	1981	
PERSONNEL	46.9%	47.4%	48.8%	4%
MAIN COMPUTERS AND RELATED DEVICES	28.9	27.6	25.6	(11)
SMALL COMPUTERS/ PROGRAMMABLE TERMINALS	2.4	3.1	3.5	45
NON-PROGRAMMABLE TERMINALS	2.3	2.4	2.5	9
COMMUNICATIONS	3.1	3.7	4.2	35
SOFTWARE (PURCHASE/LEASE)	3.7	4.3	4.8	29
PROCESSING SERVICES (OUTSIDE)	1.8	1.6	1.1	(39)
OTHER	10.5	9.6	9.3	(11)

SOURCE: INPUT EDP USER PANEL, 1979

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EXHIBIT IX-3

RESPONDENTS LOOKING FOR
APPLICATIONS SOFTWARE

INDUSTRY SECTOR	NUMBER OF RESPONSES	PERCENT OF RESPONSES	
		YES	NO/ NO ANSWER
DISCRETE MANUFACTURING	122	52%	48%
PROCESS MANUFACTURING	101	58	42
TRANSPORTATION	14	50	50
UTILITIES	26	46	54
WHOLESALE DISTRIBUTION	22	32	68
RETAIL TRADE	21	52	48
BANKING AND FINANCE	53	55	45
INSURANCE	69	43	57
EDUCATION	42	40	60
SERVICES	19	47	53
OTHER	21	48	52
TOTAL/AVERAGE	510	48%	52%

SOURCE: INPUT EDP USER PANEL, 1979

INPUT

X AN ANALYSIS OF SMALL COMPUTER
             SYSTEM VENDORS

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X   AN ANALYSIS OF SMALL COMPUTER SYSTEM VENDORS

A.   OVERVIEW OF THE INDUSTRY

* The distinction between a general computer and a minicomputer continues to become increasingly blurred. Minicomputers have grown larger in word size and addressable memory.   They now offer more sophisticated software, including all of the major programming languages, data base management systems, virtual memory, communications networks, and even portable applications packages.

    - Prices for traditional mainframes have dropped so low that many cost less than the top-end and even middle-range minis.

    - All of the major mainframe manufacturers also offer minicomputers or small business systems, and Honeywell in particular has turned the mini into the most profitable portion of its business.

* Minicomputer vendors, who have been proclaiming the virtues of distributed processing for years, saw the concept "legitimized" when IBM announced the 8100 and then the 4300 series, both of which are capable of either standalone or network operation.

* Users who were formerly content to consign minicomputers to process control functions now must wrestle with the cost/benefit and risk analyses of

installing distributed processing immediately, using non-IBM minis at the nodes, or waiting two years for delivery on the 4300s or 8100s.

- Far and away the most significant EDP event of 1979 was the IBM announcement of its 4300 series in January.

- Not only IBM and its customers were affected. All the other mainframers and plug compatible manufacturers soon followed with announcements of their own new, competitive products.

- The top tier of minicomputer manufacturers took competitive action to maintain (and later increase) market share, since there is not much performance difference between the 4300s and the Hewlett-Packard 3000 or Prime 750, for example.

    - Both of these machines would normally compete against the System/38, also in the same class; but when delivery dates for the IBM system were pushed back nine months, both Hewlett-Packard and Prime saw the delay as a competitive opportunity.

- New company entries into the small computer distribution market continue to occur with accelerating frequency. They include:

    - Semiconductor manufacturers.

    - Turnkey vendors.

    - Remote computer service companies.

    - Distributors of office equipment and electronics.

- The older and more traditional suppliers have an edge on the new vendors since they have previously-developed software in place, while new arrivals currently require two to three years for development.

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- In 1980, the cost of manufacturing the CPU and main memory represents about 30% of the total system cost, compared to 80% five years ago, since peripheral devices now represent a greater percentage of the cost build-up on total system hardware.

- One strategy, employed by vendors eager to accelerate successful market entry, is to acquire a company familiar with and already occupying a position in the industry. Some of the recent acquirors and acquirees include:

  - McDonnel Douglas Automation and Data 100.

  - Northern Telecom and Sycor.

  - Perkin Elmer and Interdata.

- Other vendors are changing their strategy of marketing:

  - Microdata is concentrating on the end user rather than the OEM market.

  - All traditional vendors are tending to increase the range of their small computer product line upward (e.g., HP, IBM, DEC).

- These factors are tending to drive the average system price upward, despite the decreasing cost of manufacturing, and to permit an "after market" of 15-25% for maintenance, software, and product upgrading when selling to the end user.

- Vendors of the 32K bit "supermini" perceive a window in the market through much of 1980 resulting from IBM's failure to provide timely deliveries on the 43XX and System 38 product lines.

B. SIGNIFICANT EVENTS AMONG SMALL COMPUTER SYSTEM VENDORS

1. BASIC FOUR

- Basic Four became one of the first minicomputer vendors to announce an electronic mail capability as part of its networking software. Their Business Information Network also provides automatic information transfer, down-line program loading, distributed data processing, and word processing on any of its four models, using either its own network or 2780 or 3780 protocols to a main host or timesharing service.

- Late in 1979, Basic Four announced price cuts on its largest model, the 730, and reduced prices on its 75MB disk drive. At the same time, terminal capacity was doubled from 16 to 32 CRTs on the 730 and raised from 12 to 16 on the model 610.

2. BURROUGHS

- Burroughs announced three new models in its B1800 series, superseding the B1825, B1835, B1865, and the earlier B1860. Prices range from $60,000 to $133,000 for typical systems. Software is unbundled and ranges from $128 to $458 per month for the master control program, plus additional amounts for the optional BASIC, COBOL, or FORTRAN compilers.

    - The new Burroughs systems correspond roughly to the IBM System/38 in performance.

3. COMPUTER SYSTEMS DEVELOPMENT

- Ex-Cincinnati Milacron executives joined together to form Computer Systems Development, Inc., at first hoping to buy out and take over Cincinnati Milacron's George system, but then instead developing their own Sentinel system compatible with the Series/1.

4.   DATA GENERAL

• Data General has moved strongly to unify its systems software area with an "Advanced Operating System" (AOS) that will operate on any of the Eclipse line of commercial systems and which has a subset (MICRON) that is fully compatible on the DG Micro-NOVA line of microcomputers.

• To ease the hardware/software diagnostic process, DG announced the D4 and D5 diagnostic terminals which provide concurrent voice and data communications between the user's location and the central service facility. The data/voice link is accomplished via specially-configured, built-in Intertel modems which automatically interrupt voice communications for brief intervals of data transmission. Both terminals can also function as system consoles or applications terminals on any ports of Data General commercial systems computers.

5.   DATAPOINT

• Datapoint Corporation has adopted a prepackaged approach to offer price reductions on its Attached Resource Computer (ARC) systems.

- The Datapoint 4734 Arcpac, priced at about $60,000, has 20 megabytes of disk storage and 420K bytes of user memory, while the 4754, priced at about $85,000, has 120 megabytes of disk storage with 420K bytes of user memory.

- Both configurations include the same software: disk operating system, Basicplus, RPGplus, batch and interactive Ansi Cobol, Databus, Data-share, Assembler, and Communications. Five multilingual user partitions are supported by each package.

- The Arcpac configurations are aimed at competing systems, such as the Data General M/600, Hewlett-Packard 3000 Series 33, and DEC PDP-11/60.

-    Datapoint now also offers a leasing plan on its model 1500 small computer.

6.   DIGITAL EQUIPMENT

●   Digital Equipment Corporation continued to open retail stores to market its line of small business computers and word processing systems. It now has stores in Massachusetts, New Hampshire, Pennsylvania, and California.

●   DEC joined the other major mainframe and minicomputer manufacturers in cutting memory prices while raising the maximum memory size that can be attached to several of its models in the System 20 series, as well as the VAX and PDP-11 series.

●   In 1978, DEC announced the "VAX (Virtual Address eXtension)." Sometimes referred to as a "megamini," the VAX uses a 32-bit word length. Billed as an extension of the PDP-11 line, the VAX series is likely to evolve into DEC's leading product line.

●   On the development side, DEC has concentrated upon product engineering and has avoided vertical integration (with few exceptions, DEC purchases its semiconductors in the open market), emphasizing solidly engineered product design with current technology. DEC is rarely at the leading edge of computer science technology but typically waits for others to pioneer in such areas as microprocessor design, MOS memory, etc.

●   Due to technological advances and DEC's own substantial growth, the company now finds itself in an interesting competitive squeeze:

-    On the low end, DEC faces the semiconductor suppliers who are able to produce and sell 8- and 16-bit microprocessor devices and micro-computer systems at lower costs than DEC.

- On the high end, DEC is clearly on a path placing it in direct confrontation with IBM. In particular, the IBM 4300 product line is directly price/performance competitive with DECsystem-20 and VAX systems.

- Evidence of DEC's shift in strategy has been its reorganization from product line functional organization to industry market orientation.

  - Currently, DEC has 13 industry-oriented product groups in an organization strikingly similar to that of some of the large mainframe competitors.

  - The reorganization of DEC into the 13 profit and loss centers, its new focus on applications, and its abandonment of the low-end microcomputer market, suggest that DEC will move beyond its concentration on knowledgeable users and OEMs and will broaden its market among end users. In addition to competing with its own OEM base, DEC is clearly entering the IBM arena.

7. DIGITAL SCIENTIFIC

- Long-time 1130 users who gravitated to Digital Scientific's 1130-compatible Meta systems can now move up to the Meta 4/5000 systems, said to be in the 370/148 range in performance. But the new system will also enable Digital Scientific to attract new customers other than former 1130 users.

  - Digital Scientific was the originator of the 158-compatible development program, later acquired by National Semiconductor, and turned into the AS line marketed by Itel.

- The Meta 4/5030 system configuration for running the multiprogramming, timesharing operating system is a 256KB CPU, with console, card reader, printer, 200MB of disk storage, and support for 16 asynchronous communications lines. This configuration would sell for approximately $140,000.

8. FOUR-PHASE

- Promoted as an alternative to the 8100, Four-Phase Systems introduced its IV-60 system in April 1979. It is not 8100 plug compatible, but does attach to IBM hardware as a 3270 equivalent, and offers easier software, and an up-to-35% lower price. Another model, the IV-65, is the same but can attach up to 24 terminals with 1920 character screens.

    - The new models fall in the middle of the firm's line and offer capabilities for multi-application operations in either a standalone or communicating mode. Available functions are source data entry, central inquiry, and word processing.

9. GENERAL AUTOMATION

- General Automation announced the availability of a single 13X15-inch megabyte board, selling for about $15,000, for users of its GA-16/440 and GA-16/550 computers.

    - Also announced was a maintenance dispatch system based on the GA-16/220 computer. The system is designed to match and schedule maintenance personnel, tools, and required work skills with maintenance duties in medium to large factories or process plants. The system is priced from $45,000.

10. GENERAL ROBOTICS

• General Robotics entered the market with its Constellation series that is DEC LSI-11 compatible. The systems range from $9,000 to $30,000, depending mainly on the amount and type of disk storage that is included. They will run the DEC RT-11 software products.

11. HARRIS

• Harris Corporation introduced a number-crunching, 48-bit word computer at the top of its regular line of 24-bit scientific and engineering computers. The 48-bit-word, floating-point operation uses an 8-bit exponent and 39-bit mantissa.

 - In the commercial line, the model 1600 data entry/remote job entry system has been upgraded with a new processor that is faster and larger than previous models. The new product supports up to 192KB of main memory and runs at 1.4 million instructions per minute, three to four times faster than the previous model. The additional memory capacity enables concurrent multiple job entry or data entry applications to run on the same processor. Prices for the new systems start at $80,000.

12. HEWLETT-PACKARD

• Hewlett-Packard responded to the introduction of IBM's System/38 in late 1978, by cutting prices on its 3000 Series 3 and Series 33.

 - Prices on all types of memory for the 1000 series (standard, error-correcting, and high performance types) were cut in 1979 by approximately 40%, to a low of $18,000/MB for standard, 595ns memory. The Series 1000 Model 45 thus became available at prices starting at $45,000 for this engineering and scientific machine, which nevertheless can run the IMAGE/1000 data base management system and link to the larger 3000 series commercial processors.

-       The HP 300, which uses silicon-on-sapphire (SOS) technology, was extended to accommodate one or two workstations for program development. The screen on the workstation can be split into several windows which may be manipulated independently. Through the use of a virtual memory technique, the windows may scroll horizontally and vertically through large information files for viewing and editing purposes. The workstations carry a $12,500 price tag. Each workstation can be upgraded to a full HP 300 for a price of $23,000.

13.   HONEYWELL

●   In mid-1979, Honeywell switched the organizational structure of its former minicomputer and terminal operations into separate functional divisions for marketing, manufacturing, and R&D. The new vice presidential positions were filled by promotions from within the company.

-       The move was generally regarded as an attempt to refine Level 6 marketing efforts and reduce manufacturing costs.

●   Honeywell introduced a new factory management system that can be operated either as a standalone Level 6 program, or over terminals and a communications processor to a remote Honeywell mainframe.

-       The new systems bring Honeywell into a market dominated by NCR, IBM, and Hewlett-Packard, but Honeywell is counting on much of its installed base of manufacturing companies as potential customers.

-       The system provides all functions from shop-floor data collection via badge readers and data entry terminals, through a production-scheduling system, an inventory-management/materials-requirements planning system, and a time and attendance reporting system. Pricing for a typical installation comprising 20 data collection stations, a Series 60 Level 6 Model 43 CPU, and assorted peripherals would be slightly over $100,000, plus software license fees of $280/month for all three applications.

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14.   IBM

- The 4300 was the most significant announcement from IBM over the past year. This product leapfrogs into the forefront of new technology, and makes it extremely difficult for plug compatible manufacturers (PCMs) to achieve a technological equivalent with IBM as they have been able to do in the past.

- The 4331, the smallest of the "E" series, falls into the category of a small computer system (Class C) and has been designed primarily as a host processor, whereas the 8100 is intended to be a satellite processor.

- There is some overlap between DPD's 4300 series and the top of the GSD 30 series line with the System/38.

- IBM broke new ground (for IBM) by announcing OEM pricing discounts on the Series/1. The amount of the discount, ranging from a modest 5% for quantity 50 to a 15% maximum for quantity 150, was not considered impressive, although the value of the discount is actually greater than it seems when the low, quantity 1 price is taken into account. Nevertheless, it marked the first time IBM has offered quantity discounts on any of its hardware. (It had previously offered quantity discounts only on supplies.)

  - Contrary to common distributor practice, items in the various categories (processors, printers, disk drives, keyboard displays, and tape units) could not be assorted to obtain a higher total quantity discount. Furthermore, the discount is given in the form of a rebate at the end of the 18-month installation period, rather than as reduced rates throughout the period.

- Earlier last year, the General Systems Division had announced technical enhancements to the System/34 in the form of the number of workstations that may be attached, support for MICR document readers, and software support for processor-to-processor communications.

- At the same time, a slower and cheaper version of the Series/1 was announced, together with tape and disk drives containing new technology. Both tape and disk drives are being made by outside suppliers.

- A new communications controller for the Series/1 was offered that attaches a total of eight lines (in two groups of four) by means of adapters.

- New Series/1 software included the Event-Driven Executive (EDX), formerly a field-developed program; a Fortran 4 compiler and object support library, including the mathematical and functional subroutine library; and a command language facility that is an addition to version 4 of the Realtime Programming System (RPS).

15. MICRODATA

Microdata, which has come under increasing competition from Prime Computer, announced in May 1979, the release of three new series between its earlier Vantage entry-level system at $32,000 and the Royale-C at $61,000, which offer better price/performance and a broader line between low and high systems.

- The model 6550 demonstrates the increase in price/performance by Microdata. The basic model comes with 32K of memory, a 50MB disk drive, two CRTs, and a 150 lpm printer for essentially the same price as the old Royale-C which had only one CRT and a slower printer. The 6550 can be expanded to 128K and 32 terminals.

- The new entry-level system, the 2200, includes 16K of memory, a magnetic tape system to provide disk storage backup, a 165 cps matrix printer, and a CRT terminal with attachments and an open communications port for diagnostics and service. The system can be expanded to 64,000, eight terminals, a 600 lpm printer, and a 20MB disk for a total of about $45,000.

- Microdata also announced its Screenpro, an interactive screen processor which cuts programming time by guiding users through a menu-driven sequence of steps to set up terminal displays and to provide for the simplified creation of programs for data input and file maintenance procedures.

o Microdata's acquisition by ITT was broken off in July 1979, based on the pending $90 million patent infringement lawsuit against Microdata by Pick & Associates. However, a deal was eventually worked out with McDonnell Douglas, who acquired the firm for about $75 million.

16. MODULAR COMPUTER

- Modular Computer Systems added two new processors to the middle of its Classic line at $23,800 and $29,500, respectively. Both new models are compatible with the MAX III and MAX IV operating systems. The difference between them is the use of an arithmetic accelerator in the 7035's modular bus control (MBC) option slot, providing high-speed, floating-point and shift operations, according to the company.

    - Features include register-to-register instruction execution of 300 nanoseconds in most cases, memory management capability providing addressability of up to 512K bytes, and a two-word-deep instruction/operand stack that uses the CPU pipeline to memory.

    - Modcomp also announced new disk and tape peripherals and two new software packages: a timesharing executive/transaction processor called TSX, and a data base management system named Infinity.

17. MOHAWK DATA SCIENCES

- Mohawk Data Sciences Corporation enhanced its Series 21 distributed processing systems by supplying 48K bytes of user memory on the entry-level System 21/20, which formerly had none, and providing the same amount on the System

21/40, which had only 32K previously. Both systems can be expanded to a maximum of 96K.

- The top-of-the-line System 21/50 now has 96K bytes standard, and can be expanded to 256K Prices for additional memory increments on all three models were cut by about 50%.

- MDS also introduced word processing software that can be used with a standalone Series 21 configuration or in a shared logic arrangement with up to four terminals and disk drives. Text can be displayed in either 12 lines of 40 characters or 24 lines of 80 characters.

- Concurrency mode, allowing two programs to run at the same time, was extended downward from the Series 21/50 to all models in the line that are equipped with at least 96K of memory.

18. NIXDORF

- Nixdorf Computer Corporation became another in the line of minicomputer manufacturers who now offer word processing capability when it announced its Multi-Text 8840 system early in 1979. The maximum system, comprising four terminals, two printers, and the 64K byte processor, sells for $40,000. Units can be purchased separately as needed, or the entire configuration can be leased on a 36-month plan.

19. PERKIN-ELMER

- Perkin-Elmer announced its second-generation supermini in early 1979. The 3220 has about the same performance as the earlier Interdata 8/32, but only costs half as much, at $46,000 for an entry level 256KB model. The machine can be expanded to a maximum of one megabyte of main memory for a total cost of $72,000.

- The new machine runs all software written for the earlier 7/32 and 8/32 processors. It is targeted to compete with the DEC VAX-11/780 and the Prime Computer 400.

20. PRIME

● Prime Computer announced a new top end to its line, consisting of models 450, 550, 650, and 750, priced from $35,000 to $130,000.

- The 450 marked Prime's entry into the OEM market, while the other three models were addressed to the needs of end users and replaced the earlier models 400 and 500. The new 550 costs 35% less than the 400, but is more than three times as fast running Cobol programs.

- The top three machines feature cache memory, a decimal arithmetic instruction set, as well as floating point instructions in either firmware or hardware. Thus, they are expected to compete against both the DEC VAX-11/780 and DEC system 20 models, Data General's Eclipse M-600, and Hewlett-Packard's 3000 Series 2.

- Prime also announced Primenet, a $5,000 networking capability that enables Prime systems to communicate among themselves, and a separate package for $7,000 that permits Prime computers to be interfaced to a variety of terminals and communications links with multiple protocols and remote job entry options, including Bisync for Hasp and 2780, high-level data link control (HDLC) for X.25, Control Data 200UT, Univac 1004, and ICL 7020. Both packages require a $4,000-5,000 network controller to operate.

- Other software includes a distributed processing executive, priced from $5,000 to $12,000, that conforms to IBM 3271/3277 protocols. In addition, there are an interactive data management package, PL/1 and Fortran compilers, and source-level debugging tools.

INPUT

●   Prime began organizing a dealer network to market the new systems, including several dealers who also market the Microdata Reality line. The impetus for the move was the acquisition of rights to two Reality-compatible packages called Information 1000 and Information 5000. These packages are said to be useful both to first-time users and to Reality users who need systems larger than those offered by Microdata and want to retain compatibility with the Reality line.

   -   Information 1000 systems will range in price from $75,000 to $300,000, while Information 5000 systems will range from $160,000 to $500,000. Prices include Prime 400 and 750 processors whose prices and performances have been modified for the first-time user market. The Primos OS, the Information software, and whatever additional software or peripherals are needed are all included.

   -   The Informaton software provides a simplified user interface; a programming language called Inform/Basic, derived from the Reality Data/Basic; Inform, a user language similar to the English software used with Reality systems; and Info/DMS, a dictionary-driven data management system.

21.   S.E.L.

●   Systems Engineering Laboratories did not alter prices on its basic 32/30, but did raise prices on memory increments and higher-capability processors. However, it boosted the memory speed by 50% and increased the maximum capacity to one megabyte on the 32/30 and 32/57 models, and to four megabytes on the 32/77 model.

22.   TEXAS INSTRUMENTS

●   Texas Instruments added two models to the low end of its DS990 line, and packaged the high end in two systems targeted to compete with DEC and Data General products.

- The DS990 Model 1, priced at $9,450 with two diskette drives, is a single-user, desk-top system designed for low-cost data entry and standalone small-business applications. The DS990 Model 2, priced at $13,200 with two diskette drives and two Model 911 video display terminals, is a multi-user system.

- 3270-compatible interactive communications software, a display screen forms-generation package, and an interactive data base management system are all available for license fees from $1,500 to $2,400 per year.

- The enhanced pre-packaged systems, known as the Model 20 at $64,500 and the Model 30 at $77,400, offer 256KB of error-correcting memory with a 24K byte cache controller, two Model 911 video display terminals, 50 megabytes of disk storage, and magnetic tape backup. A second disk can be optionally selected for backup. The DS990 Model 30 is basically a larger-capacity version of the Model 20, with 200 megabytes of storage, and a choice of magnetic tape storage or an additional DS200 disk for backup.

- The DS990 Models 20 and 30 can be expanded to include approximately 20 terminals and a total of four disk drives.

23. SPERRY UNIVAC

• Sperry Univac announced the top of its BC/7 line of small business systems, known as the V77-800. It is intended to operate either as a standalone system or as part of a distributed network linked to Univac or IBM host processors. Designed for both the scientific and commercial markets, the V77-800 supports from 128K bytes to 2 megabytes of 600 ns memory.

- Typical V77-800 systems are in the $35,000 to $181,000 price range. The former consists of a CPU with 256K bytes, a variety of peripherals, and the Summit operating system. The latter is a half-megabyte system with expanded peripherals and Summit, Cobol, Fortran, and Total.

24. WANG

• Wang Laboratories made news by topping out its virtual storage computer line with the VS 100, offering throughput claimed by Wang to approach that of the 3032.

- The VS 100 comes with main memory of 256K to two megabytes and can support up to 128 workstations and 128 peripherals, including disk storage of 4.6 billion bytes. The 32-bit processor contains a 32K cache buffer and a 64-bit system bus.

- The smallest configuration, with 256K bytes of main memory, Assembler, and one language compiler, lists for $69,000 and a one-megabyte version is $93,000. Memory increments of 256K bytes are priced at $9,000.

- Languages available include Assembler, Cobol, Basic, RPG II, Fortran, and PL/1. Data base management and word processing packages are also available, including a relational DBMS.

- The VS line's communications capabilities also have been expanded to provide networking in an IBM 3270 interactive mode in addition to the IBM 2780/3780 batch communications previously available. A new I/O processor that emulates the IBM 3271 cluster controller is available in three models handling one, two, or three bisynchronous lines.

C. TYPICAL SMALL COMPUTER SYSTEM CONFIGURATIONS AND PRICES

From a recent survey performed in the United States, it was determined that those systems having the largest-quantity shipments through 1979, by class designation and average system price, were:

- Class A systems.

    - System prices ranged from $20,000-49,000.

    - Largest shipments/average prices:

        - DEC PDP-11/34 $44,000

        - IBM Series/1   45,000

        - DG Nova 3   32,000

- Class B systems.

    - System price ranged from $50,000-99,000.

    - Largest shipments/average prices:

        - IBM System/34 $ 775,000

        - DEC PDP-11/60   94,000

        - IBM System/32   77,000

- Class C systems.

    - System prices ranged from $100,000-200,000.

    - Largest shipments/average prices:

        . DEC PDP-11/70 $ 189,000

        . Hewlett-Packard HP 3000   164,000

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APPENDIX A: DEFINITIONS

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- BRANCH is a physical location or street address and part of:

  - A large corporation.

  - A department of a large municipal government.

- DISTRIBUTOR purchases the small business computer on an OEM basis from the manufacturer and markets it to the end user. It may or may not provide a turnkey system.

- DISTRIBUTED DATA PROCESSING (DDP) is the deployment of program-mable intelligence in order to perform data processing functions where they can be accomplished most effectively, through the electronic interconnection of computers and terminals, arranged in a telecommunications network adapted to the user's characteristics.

- END USER may buy a system from the hardware supplier(s) and do his own programming, interfacing, and installation. Alternately, he may buy a turnkey system from a systems house or hardware integrator.

- ENTERPRISE is a business organization.

- ESTABLISHMENT is a physical location or a street address and can be:

    - An independent enterprise.

    - A branch of a major enterprise.

- GENERAL PURPOSE COMPUTER SYSTEMS is a computer designed to handle a wide variety of problems; includes machine room peripherals, systems software, and small business systems.

- HARDWARE INTEGRATOR . develops interface electronics and controllers for the CPU, sensors, peripherals, and all other ancillary hardware components. He may also develop control system software in addition to installing the entire system at the end user site.

- INFORMATION PROCESSING is data processing as a whole including use of business and scientific computers.

- INSTALLED BASE is the cumulative number or value (cost when new) of computers in use.

- MICROCOMPUTER combines all of the CPU, memory and peripheral functions of a computer on a chip of silicon. It may be sold in an integrated circuit package or with the addition of more memory and peripheral circuits packaged on a board of a console. Eight bit computer on a chip used as a component.

- MINICOMPUTER Usually a 12 to 64 bit computer which is provided with limited applications software and support and represents a portion of a complete, large system.

●   PERIPHERALS Includes all input, output, and storage devices, other than main memory, which are locally connected to the main processor and are not generally included in other categories, such as terminals.

●   SMALL BUSINESS COMPUTER for the purpose of this study, is a system which is built around a central processing unit (CPU), and which has the ability of utilizing at least 20M bytes of disk capacity, provides multiple CRT work stations, and offers business oriented system software support.

●   SOFTWARE PRODUCTS This category is for users' purchases of systems and applications packages for use on in-house computer systems. The figures quoted include lease and purchase expenditures, as well as fees for work performed by the vendor to implement and maintain the package at the users' sites. Fees for work performed by organizations other than the package vendor are counted in professional services. There are two subcategories:

    -   SYSTEMS PACKAGES OR SYSTEMS SOFTWARE are operating systems, utilities, and language routines that enable the computer/communications system to perform basic functions. The software is provided by the mainframe manufacturers with their hardware; other vendors provide improved versions of this and special-purpose routines. This classification includes compilers, data base management software, diagnostic software, and sorts.

    -   APPLICATIONS PACKAGES OR APPLICATIONS SOFTWARE are software which perform processing to serve user functions. They consist of general purpose packages, such as accounting and inventory control, and special purpose packages, such as personal trust, airline scheduling, and demand deposit accounting.

- SMALL COMPUTER SYSTEM for the purpose of this study, is a system consisting of a minicomputer and associated peripherals segmented into the following price ranges:

    - Class A (Small): $20,000 to $49,000.

    - Class B (Middle): $50,000 to $99,000.

    - Class C (Large): $100,000 to $200,000.

- SYSTEMS HOUSE Integrates hardware and software into a total turnkey system to satisfy the data processing requirements of the end user. It may also develop system software products for license to end users.

- TURNKEY SYSTEM is composed of hardware and software integrated into a total system designed to completely fulfill the processing requirements of an application (or applications) for a user.